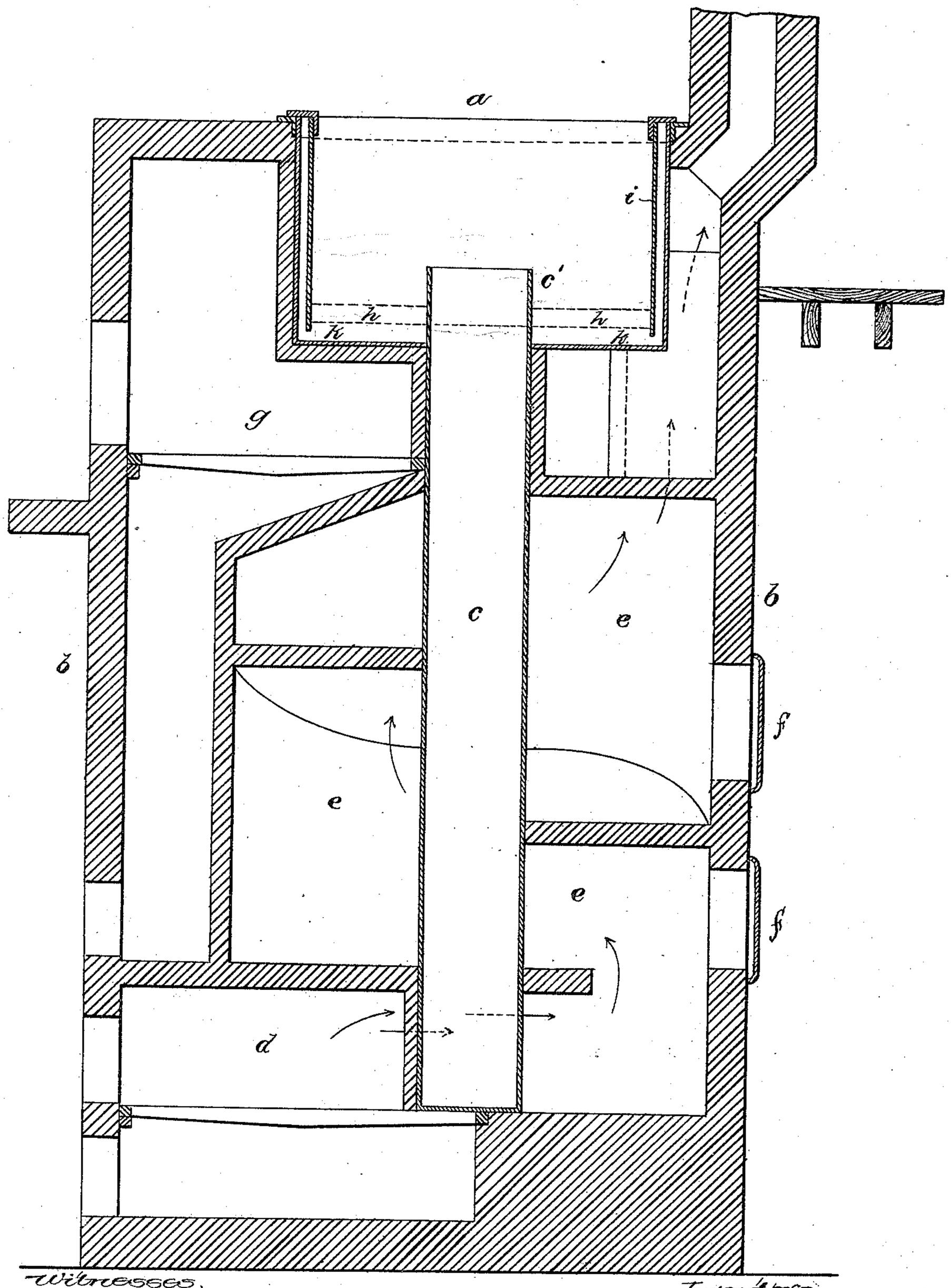
(No Model.)

E. I. BRADDOCK & D. A. RITCHIE.

APPARATUS FOR COATING METALS.

No. 311,284. Patented Jan. 27, 1885.



Witnesses.
Henry Marsh.
B. L. Noyes.

Inventors.
Edward I. Braddock.
David A. Ritchie. and.
by Crosby & Gregory Attys.

UNITED STATES PATENT OFFICE.

EDWARD I. BRADDOCK, OF MEDFORD, AND DAVID A. RITCHIE, OF CHELSEA, MASSACHUSETTS.

APPARATUS FOR COATING METALS.

SPECIFICATION forming part of Letters Patent No. 311,284, dated January 27, 1885.

Application filed April 28, 1884. (No model.)

To all whom it may concern:

Be it known that we, EDWARD I. BRADDOCK, of Medford, county of Middlesex, and DAVID A. RITCHIE, of Chelsea, county of Suffolk, State of Massachusetts, have invented an Improvement in Apparatus for Coating Metals, of which the following description, in connection with the accompanying drawing, is a specification, like letters on the drawing representing like parts.

Our invention relates to an apparatus for coating metals, it being especially intended for galvanizing iron, and is shown embodied in an apparatus especially adapted for dipping or coating long articles, such as iron rods or bars or sheet-metal tubing such as employed for water-conductors and similar purposes.

Iron, as heretofore usually practiced, has been galvanized or coated with zinc by dipping the iron, after having its surface previously cleaned by the action of an acid, in a bath of melted zinc contained in a tank of sufficient size to receive the said articles, and in some cases the articles are previously tinned or coated with some other metal. As the article has to be wholly immersed, the tanks have been made very large when articles having very large dimensions—as sheet-metal pipe or long rods or bars—have been treated, and such large tanks and vessels are very costly and contain a very large mass of molten metal, the whole of which must be maintained at the necessary heat to keep it in a molten state. Articles that are coated in this manner, as a general thing, have only one large dimension, or are long and slender rods or tubes, or long thin sheets; and the object of our invention is to provide an apparatus for dipping such articles with the least expenditure of heat, and with a comparatively small-sized receptacle for the molten metal.

The apparatus consists, essentially, of a tank of comparatively small dimensions, having extended downward from its bottom a tube of sufficient length to receive the articles to be coated when plunged down through the molten metal in the said tank and into the said tube, and in practice the tube is preferably filled with molten lead, while the main tank or vessel above is filled with molten zinc, which, being of less specific gravity, floats upon the top of the lead. The tube extends up a short distance above the bottom of the tank, which is also covered with lead for a small depth, and the dross, being heavier than the zinc, will accumulate around the top of the tube and rest on the lead near the bottom of the tank below the zinc. The tube is heated by a fire in a furnace at its lower end, having a flue which surrounds the tube, and is provided with means for regulating the temperature, which is maintained at the proper height for keeping the lead in a molten state, and another furnace is provided for the tank containing the zinc, in which a hotter fire is maintained, as is necessary on account of the higher temperature required for the fusion of zinc. The articles to be galvanized are thus plunged wholly through the bath of zinc and into the lead, and then on being withdrawn pass through the zinc again, they being exposed to the zinc last. Molten zinc is found to have a very destructive effect upon the iron tanks containing it, and in order to obviate the necessity of frequent renewals of the tank the latter is, in accordance with the present invention, provided with an internal jacket or wall extending nearly to the bottom of the tank, and the space between the said internal wall or jacket and the side wall of the tank is filled with lead, so that the inner surface of the tank is acted upon only by the lead, which has but little, if any, destructive effect on the iron. When the jacket is eaten away or destroyed by the zinc, it is a comparatively easy matter to renew it.

The drawing shows in vertical section an apparatus for coating metals embodying this invention.

The receptacle for containing the bath of molten metal in which the articles to be coated are dipped consists of a main tank or reservoir, *a*, preferably of wrought-iron, supported in the upper portion of the masonry *b* of the furnace, and having a long extension or auxiliary reservoir, *c*, shown in this instance as a tube extending vertically downward from

the lower portion of the main tank *a*, and being of sufficient size to receive the articles to be coated when the latter are passed downward through the material in the tank *a*. The said tube, as well as the tank and jacket hereinafter described, are all preferably of wrought-iron, such as commonly employed for steam-boilers. The masonry *b*, near its base, contains a furnace, *d*, of usual construction, having a flue, *e*, through which the products of combustion from the said furnace circulate around the tube *c*, as indicated by the arrows, thus maintaining the said tube at the proper temperature to fuse the material in it, the said material being preferably lead, which fuses at lower temperature than zinc, which is to form the main coating of the articles. Suitable doors or dampers, *f*, are provided for the admission of cold air into the flue *e*, to regulate the temperature of the tube *c*, the fire in the furnace *d* being kept quite low, or at about a red heat. The masonry *b*, near its upper end, is provided with another furnace, *g*, the fire in which acts upon the main tank *a*, and is kept at a high heat, as is required for melting the material in the said tank, which is in this instance zinc. The upper end of the tube *c* extends above the bottom of the tank *a*, as shown at *c'*, so that the dross or impurities from the metal that are heavier than zinc will accumulate around the sides of the said tube near the bottom of the tank *a*, as shown at *h*, thus leaving a column of clear liquid metal in the line of the tube through which the articles being dipped pass.

In order to prevent the rapid destruction of the tank *a* by the amalgamating action of melted zinc, it is provided with a bottomless internal jacket or wall, *i*, and the space between the said jacket and the side wall of the tank is filled with lead, which also covers the bottom of the tank for a slight depth, as shown at *k*, floating the dross *h*, so that the entire inner surface of the tank *a* is exposed only to the action of melted lead, which does not affect it. When the jacket is wholly eaten away by the action of the zinc, it may be easily removed and another one substituted at far less expense than would be required for providing a new tank *a*, and it will be seen that the jacket *i* merely has to separate the two liquid metals, the pressures of which about balance one another, so that the jacket may be used when it would be much too thin to safely contain the entire mass of molten metal.

In operation the articles to be coated, having been previously treated by acids or otherwise to prepare their surfaces to receive the coating, are thrust down through the melted zinc in the tank *a* into melted lead in the pipe *c*, and then, upon being withdrawn, again pass through the zinc, so that the coating on the surface is mainly zinc, although the slight amount of lead that is alloyed with it is rather beneficial than otherwise.

It will be seen that by an apparatus of this kind a comparatively small body of zinc in the tank *a* may be caused to act upon the entire surface of an article having one of its dimensions much greater than any dimension of the said tank, and that consequently articles may be properly coated which by the usual method require a very large tank, and consequently a very large body of melted zinc, which would require a large expenditure of fuel to maintain it at the proper temperature. The long articles entering the melted zinc endwise disturb but a small portion of its surface, and it is comparatively easy, when withdrawing the said articles, to keep the said small portion of the surface of the bath clean and free from dross, so that a smooth and perfect coating is deposited on the surface of the article being coated. The main function of the tube *c* is to form a receptacle to receive the articles, so as to enable them to be drawn through the bath of molten metal above the said tube, and the lead in the tube forms a support for the metal in the tank, it requiring less fuel to keep the lead in a molten state than if the zinc filled the entire receptacle, composed of a tank and tube; and, furthermore, as before stated, the presence of the lead in the coating of the articles is rather beneficial than otherwise. The part of the tube *c* passing through the furnace *g* may be protected by masonry or fire-brick, and the said tube, being exposed to a comparatively low heat at its outer side and to the action of melted lead on its inner surface, will last a very long time.

While an apparatus of this kind is especially adapted for the treatment of articles having one large dimension, it is also advantageous even for small articles—such as bolts, nuts, &c.—that can be wholly contained in the main tank, as the presence of the vertical body of metal in the tube is found to have a tendency to equalize the temperature of that in the tank, preventing it from too great cooling when a considerable mass of cold metal is immersed in it.

It is obvious that the extension *c*, herein shown as a tube, may be of any desired shape in cross-section, and also that it may in some cases be desirable to have two or more such extensions from different parts of the bottom of the main tank.

We claim—

1. The main tank or reservoir, combined with the auxiliary reservoir extending downward from the bottom thereof, and having its upper end projecting above the bottom of the main tank, substantially as and for the purpose described.

2. The main tank or reservoir, combined with a bottomless internal jacket adjacent to the side walls of the said reservoir, the space between the said tank and jacket containing one molten metal, which also covers the bottom of the main tank, and the tank within the said jacket containing a different molten

metal of less specific gravity, substantially as described.

3. The main tank and auxiliary reservoir extending downward from the bottom thereof, combined with independent furnaces for heating the said tank and auxiliary reservoir, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

EDWARD I. BRADDOCK.
DAVID A. RITCHIE.

Witnesses:
G. W. GREGORY,
W. H. SIGSTON.